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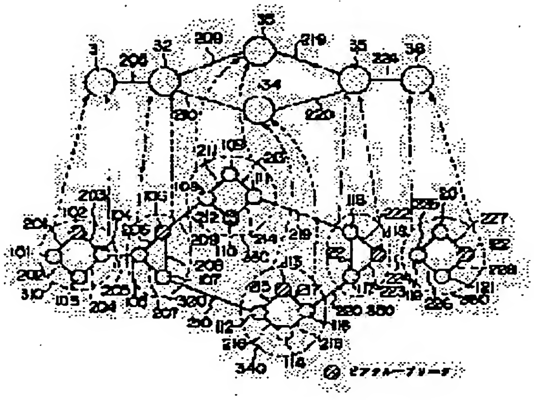
(54) PATH SELECTION METHOD AND COMMUNICATION SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide the path selection method in which a communication path is selected safely and accurately in the case of selecting the communication path in a network and the communication system using the method.

SOLUTION: In the communication network consisting of a plurality of switches 101-122 and links 201-228 interconnecting the switches, in the case of selecting a communication path by regarding a logic network including logic switches 31-36 consisting at least one switch as a logic network, each of the switches 101-122 selects a communication path on the logic network based on attribute information of the links between at least one set of boundary switches connecting to other logic switch among switches forming the logic switches 31-36 and on attribute information of links with the other logic switch.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CLAIMS

[Claim(s)]
[Claim 1] The communication network which consists of links which connect during two or more switches and said two or more switches In the routing approach which regards it as the logic network containing the logic switch which consists of two or more at least one switches, and chooses a communication path said each switch The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. the attribute information on the link during at least one pair of boundary switches, and this boundary switch — said — others — the routing approach characterized by choosing the communication path on said logic network based on the attribute information on the link between logic switches.
[Claim 2] In the routing approach which regards it as the logic network containing the logic switch which consists of at least one switch the communication network which consists of links which connect during two or more switches and said two or more switches, and chooses a communication path Said each switch considers the switch connected to others and a logic switch among the switches which constitute said logic switch as a boundary switch. The attribute information on the link of said optimal path that a safety margin serves as max among the optimal paths during at least one pair of boundary switches, this boundary switch — said — others — the routing approach characterized by choosing the communication path on said logic network based on the attribute information on the link between logic switches.
[Claim 3] Said communication network is the routing approach according to claim 1 or 2 characterized by being an ATM communication network.
[Claim 4] The attribute information on said link is the routing approach according to claim 1 or 2 characterized by being the information about an information transfer time delay.
[Claim 5] The attribute information on said link is the routing approach according to claim 1 or 2 characterized by being the information about a band.
[Claim 6] The communication network which consists of links which connect during two or more switches and said two or more switches In the communication system which regards it as the logic network containing the logic switch which consists of at least one switch, chooses a communication path, and transmits information through this selected communication path Said each switch considers the switch connected to others and a logic switch among the switches which constitute said logic switch as a boundary switch. the attribute information on the link during at least one pair of boundary switches, and this boundary switch — said — others — the communication system characterized by providing a means to choose the communication path on said logic network based on the attribute information on the link between logic switches.
[Claim 7] The communication network which consists of links which connect during two or more switches and said two or more switches In the communication system which regards it as the logic network containing the logic switch which consists of at least one switch, chooses a communication path, and transmits information through this selected communication path Said each switch considers the switch connected to others and a logic switch among the switches which constitute said logic switch as a boundary switch. The attribute information on the link of said optimal path that a safety margin serves as max among the optimal paths during at least one pair of boundary switches, this boundary switch — said — others — the communication system characterized by providing a means to choose the communication path on said logic network based on the attribute information on the link between logic switches.
[Claim 8] Said communication network is communication system according to claim 6 or 7 characterized by being an ATM communication network.
[Claim 9] The attribute information on said link is communication system according to claim 6 or 7 characterized by being the information about an information transfer time delay.
[Claim 10] The attribute information on said link is communication system according to claim 6 or 7 characterized by being the information about a band.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] In case especially this invention searches for the setting-out path of the connection between ATM SUITCHINO 1 DO for example, about ATM communication system, it recognizes the part in an ATM network as a logical ATM switching node (peer group), and relates to the ATM network which performs a path search algorithm on the logical ATM network containing the logical ATM switching node, and performs connection setting out.
[0002]
[Description of the Prior Art] In recent years, many network products by the ATM communication mode appear in a commercial scene increasingly. Many products with the ATM switch based on the criterion of UNI3.0 especially determined in ATM-Forum or UNI3.1 or an ATM interface appear in a commercial scene, and the places which transpose the network in an enterprise to ATM-LAN have been increasing in number gradually.
[0003] However, since only UNI which is an interface between the so-called switches and terminals is carried and the product of old ATM relation did not have the interface of NNI which is an interface between the so-called switching nodes and between ATM-LAN, the approach of using a UNI interface as an NNI interface for convenience has been taken.
[0004] the decision of the specification of an NNI interface is behind compared with the decision of the specification of UNI, and it is now — the actual condition is that the ATM switch carrying an NNI interface is not produced commercially.
[0005] However, as such an interface between switching nodes, ATM-Forum determines the specification of P-NNI (Private Network Network Interface) in February, 1996, and implementation of the P-NNI method is started by many ATM switch PENDA. In this P-NNI interface specification, the network which connected two or more ATM switches is recognized as a network of an imagination layered structure. And in this virtual network, it is recognizing the subnet which consists of two or more switching nodes called a peer group in P-NNI interface specification to be one logical node, and the cutback of the **** topology information to memorize is in drawing.
[0006] Thus, in case routing is performed when the network topology has been recognized as virtual hierarchy organization, the creation method of the topology information how the topology information in each subnet recognized as a logical switching node is created which degenerated poses a problem.
[0007] A method in which this logical switching node seems not to assign fixed topology information to a logical switching node as a degeneration method of topology information, or not to have topology information at reverse can be considered. However, by such method, when searching for a routing path, the loop formation of a routing path occurred, or only the paths which are not the optimal were chosen, and there was a problem of being unable to use a network resource efficiently.
[0008] An example of a communication network which used the ATM communication mode for drawing 1 as topology of the communication network which such a problem generates is shown. Two or more ATM switching nodes 101 and 102—122 exist in this communication network, and between those ATM switching nodes has a link 201 and composition connected by 202—228.
[0009] In drawing 1 , the P-NNI method which ATM-Forum specified as an interface between this ATM switching node shall be used, and topology information on each ATM switching node or a logical ATM switching node shall be delivered and received between this ATM switching node.
[0010] In the communication network of drawing 1 , the 22 above-mentioned ATM switching nodes are divided into six ATM switching nodes (peer group) 310, 320, 330, 340, 350, and 360, and each peer group is recognized to be the logical ATM switching nodes 31-36. Therefore, make into an imagination low order hierarchy's topology topology of the network constituted by 22 ATM switching nodes which were shown in the lower part of drawing 1 , and which exist really, and let topology of the logical network constituted by

six logical ATM switching nodes shown in the upper part of drawing 1 be an imagination high order hierarchy's topology.

[0011] The ATM switching node 101 in the communication network of drawing 1 used as the topology of such virtual hierarchy organization will recognize it as logical topology as shows the topology of the whole communication network of drawing 1 to drawing 2 . And when setting up an ATM connection from the ATM switching node 101, using the network of topology shown in this drawing 2 , it will search for an ATM connection's setting-out path, and signaling processing for ATM connection setting out will be performed.

[0012] usually, in order to search for the communication path which becomes the optimal [for communicating in a network], weight (for example, weight about a time delay and a band) is given to each link in a network, and the method which chooses a communication path (namely, — for example, the band which needs [the minimum or] a time delay is securable) from which the sum of the weight becomes min between the terminals which communicate is used.

[0013] An example of the weight of the link on the network shown in drawing 3 at drawing 2 is shown. On the network of drawing 2 , the case where it is presupposed that each logic ATM switching node does not have the weight of the link used as topology information in the logical ATM switching node 31-36 of drawing 1 although two or more ATM switching nodes and links exist actually is shown. The network topology of **** Li and drawing 3 will lack the logical ATM switching nodes 32, 33, 34, and 35 and the topology information on the link in 36. On the ATM network which performs such topology recognition, the above communication-path search algorithms are performed and the ATM connection setting-out approach in the case of setting the ATM connection to the ATM switching nodes 101-122 in the network of drawing 1 as below is shown as an example of an approach which sets up an ATM connection.

[0014] First, since the switching node 101 recognizes the network topology like drawing 2 , an ATM connection's setting-out path search algorithm is performed on the logical ATM network of drawing 2 .

[0015] Since the ATM switching node 122 of an ATM connection setting-out place belongs to the logical ATM switching node 36 at this time, in case a path search algorithm is performed actually, it will search for the ATM connection setting-out path from the ATM switching node 101 to the logical ATM switching node 36.

[0016] As shown in drawing 3 , supposing the weight information on the link in a network is given, as a path from which the sum of the value of the weight of a link becomes min, the path which goes via the ATM switching node and the logical ATM switching node which are called 102->104->32->34->35->36 will be chosen from the ATM switching node 101 as order. Here, in the logical ATM network shown in drawing 2 , since the logical ATM switching nodes 32, 33, 34, and 35 and the topology information in 36 are concealed, when setting up an ATM connection actually, the path of the ATM connection who sets up in these logical ATM switching nodes must be uniquely set up in each logic ATM switching node, respectively.

[0017] Therefore, after the path of the ATM connection on the logical ATM network topology of drawing 2 is chosen, the path in the logical ATM switching node 32 will be chosen, and the path in the logical ATM switching nodes 34 and 35 and 36 will be chosen one by one.

[0018] However, by the conventional method, since each logic ATM switching node performs a path search algorithm in the form where existence of the logical ATM switching nodes 32, 34, and 35, the ATM switching node in 36, and a link is disregarded, the following problems arise.

[0019] The case where the actual weight of the link in the logical ATM switching node 34 has become like drawing 4 as an example is assumed. In drawing 4 , for example, weight "50" is given to the links 215 and 216 in a logical ATM switching node, and weight "100" is given to weight "60" and a link 218 in the link 219. In accordance with the connection path chosen on the ATM network of drawing 2 , sequential setting out is carried out and an ATM connection presupposes that processing came to the logical ATM switching node 34. At this time, the actual ATM switching node 112 in the logical ATM switching node 34 to which connection setting-out processing was passed from the logical ATM switching node 32 will perform setting-out processing of a connection.

[0020] The topology information on the ATM network shown in drawing 1 which the ATM switching node 112 recognizes to drawing 5 is shown. On the network topology of drawing 5 , when the ATM switching node 112 searches for the optimal path to the ATM switching node 122 (logical ATM switching node 36) of the destination, unlike the path which the ATM switching node 101 chose previously, the result that the path of 112->32->33->35->36 is an optimal path is brought. for this reason, in case a actual ATM connection is set up, the loop formation of connection setting out will occur among the ATM switching nodes 107 and 112 actual — among the logical ATM switching nodes 32 and 34.

[0021] It is ATM-Forum in order to avoid generating of such a loop formation of connection setting out. Although the method which recognizes the TOBOROJI information on a logic node supposing the imagination star mold topology which consists of P-NNI methods by the link called Radius as the recognition approach of a logical topology configuration is shown, reference is not made about the creation method of the topology information on the imagination link called the Radius.

[0022]

[Problem(s) to be Solved by the Invention] As stated above, since topology information on a logical switching node could not be estimated to be an accuracy and insurance side, when it was going to set up a connection in a network, by the creation approach of the topology information on the conventional technique, the problem that a loop formation occurred was in the connection path.

[0023] This invention is what was made in view of this point. Each switching node in a communication network By estimating the topology information given between the switching nodes which constitute the logical switching node to be an insurance side, in case the topology information on a logical switching node that the switching node is contained is created It aims at offering the communication system using the routing approach and it of a connection's loop formation which can be performed to accuracy safely [generate namely, / selection of a communication path] at the time of routing activation.

[0024] Moreover, selection of the need band which can guarantee the demand quality notified by the user at the time of a call setup, and the communication path with which are satisfied of a time delay aims at offering the communication system using the routing approach and it which can be performed easily and certainly.

[0025]

[Means for Solving the Problem] The routing approach of this invention the communication network which consists of links which connect during two or more switches and said two or more switches In the routing approach which regards it as the logic network containing the logic switch which consists of at least one switch, and chooses a communication path said each switch The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. the attribute information on the link during at least one pair of boundary switches, and this boundary switch — said — others — by choosing the communication path on said logic network based on the attribute information on the link between logic switches In case the whole network is recognized using logical topology information, it can recognize with the value near actual topology information. Therefore, selection of a communication path can carry out to accuracy safely.

[0026] The routing approach of this invention moreover, the communication network which consists of links which connect during two or more switches and said two or more switches In the routing approach which regards it as the logic network containing the logic switch which consists of at least one switch, and chooses a communication path said each switch The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. The attribute information on the link of said optimal path that a safety margin is max among the optimal paths during at least one pair of boundary switches, this boundary switch — said — others — by choosing the communication path on said logic network based on the attribute information on the link between logic switches In case the whole network is recognized using logical topology information, network topology information more logical to an insurance side can be offered. Therefore, selection of a communication path can carry out to accuracy safely.

[0027] Moreover, since the ATM communication mode is used as a communication mode during each switch, it can use also for the network in the case of transmitting the information on a high speed and a broadband. Moreover, also when setting the connection who demands severe conditions and who transmits real-time information, such as speech information, as communicative transfer delay by using the weight about an information transfer time delay as link attribute information, the connection path which can offer the demand quality certainly can be set up.

[0028] Moreover, also when setting up the connection who demands a big communication band by using the weight about available bandwidth as attribute information on a link and who transmits wideband data, such as image information, the connection path which can offer the demand quality certainly can be set up.

[0029]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing. As an example of the topology of the communication network which consists of communication system of this invention, the operation gestalt of this invention is explained using the communication network shown in drawing 1 .

[0030] Two or more ATM switching nodes 101-122 exist, between these ATM switching nodes is connected by links 201-228, and the communication network of drawing 1 is constituted.

[0031] The 22 above-mentioned ATM switching nodes are divided into six ATM switching nodes (peer group), and let each peer group be the logical ATM switching nodes 31-36.

[0032] In drawing 1 , the P-NNI method which ATM-Forum specified shall be used as an interface between this ATM switching node, and topology information on each ATM switching node or a logical ATM switching node shall be delivered and received between this ATM switching node.

[0033] As mentioned above, make into an imagination low order hierarchy's topology topology of the network constituted by 22 ATM switching nodes which were shown in the lower part of drawing 1 , and which exist really, and let topology of the logical network constituted by six logical ATM switching nodes shown in the upper part of drawing 1 be an imagination high order hierarchy's topology.

[0034] The ATM switching node 101 in the communication network of drawing 1 used as the topology of such virtual hierarchy organization will recognize it as logical topology as shows the topology of the whole communication network of drawing 1 to drawing 2 . That is, the logical network recognized from the ATM switching node 101 will consist of the ATM switching nodes 102-104, logical ATM switching nodes 32-36 and links 201-205 that connect these, and 209, 210, 219, 220 and 224, and will recognize [the ATM switching node 101] this configuration, each links 201-205, and the information about 209, 210, 219, 220, and 224 as topology information.

[0035] Next, each ATM switching node of drawing 1 is explained with reference to drawing 6 and drawing 7 . As shown in drawing 1 , to the ATM switching node in the communication network where this invention is applied The usual ATM switching nodes 101, 103-105 which create only the topology information on the link linked to a self-node and a self-node, 107-109, 111-112, 114-117, and 119-121, Two kinds of the logical topology information creation nodes (it is hereafter called a peer group reader) 102, 106, 110, 113, 118, and 122 which create each peer group's logical topology information exist for every peer group.

[0036] An example of the internal configuration of the usual ATM switching node (equipment) is shown in drawing 6 . As shown in drawing 6 , the usual ATM switching node 600 The topology information notified through a link from other ATM switching nodes is received. Topology information reception / storage section 601 which memorizes those information, The network topology creation section 602 which creates the topology information on the whole network based on those topology information, The routing control section 603 which calculates a connection's setting-out path based on the network topology created in the network topology creation section 602, The self-node topology information creation section 605 which creates the topology information on the link linked to a self-node and a self-node based on a connection's condition set up in each ATM switching node, The advice section 604 of topology information which notifies the created self-node topology information through a link to other ATM switches is provided.

[0037] An example of the internal configuration of an ATM switching node (equipment) which serves as a peer group reader is shown in drawing 7 . . As shown in drawing 7 , the ATM switching node 700 which serves as a peer group reader Topology information reception / storage section 701 which receives and memorizes topology information from other ATM switching nodes like the usual ATM switching node 600, The network topology creation section 702 which creates the topology information on the whole network based on those topology information, The routing control section 703 which calculates a connection's setting-out path, and the self-node topology information creation section 704 which creates the TOBOROJI information on the link linked to a self-node and a self-node are provided.

[0038] Furthermore, the ATM switching node 700 which serves as a peer group reader The ATM switching node linked to ATM switching nodes other than a self-peer group memorized by topology information reception / storage section 701 The TOBOROJI information creation section 706 between border nodes which searches for the optimal path between border nodes, and creates the topology information between each border node from the TOBOROJI information on between [(it is hereafter called a border node)], Based on the topology information between each called-for border node, the logical topology information creation section 707 which creates a self-peer group's logical topology information is provided.

[0039] From the advice section 705 of topology information in the ATM switching node 700 which serves as a peer group reader, a self-peer group's logical topology information created in the logical topology information creation section 707 will also be notified through a link to other ATM switching nodes with the self-node topology information created in the self-node topology information creation section 704.

[0040] In order to avoid generating of the loop formation at the time of connection setting out shown in the conventional example in the communication network constituted by the ATM switching node of a configuration as shown in drawing 6 and drawing 7 , topology information is also respectively given to the logical ATM switching nodes 31-36 of drawing 1 .

[0041] Next, an example of how to give the logical topology information on the logical ATM switching node 34 with topology information as shown in drawing 4 with reference to drawing 8 is explained.

[0042] In drawing 8 , since the weight of the link in the logical ATM switching node 34 has become like drawing 4 , logical ATM switching node 34 self has the weight information on a link. At this time, the weight information which the logical ATM switching node 34 has is made based on the topology information between the ATM switching nodes 112 and 115 linked to the ATM switching node in the logical ATM switching node 34 in the ATM switches 112, 113, 114, and 115 in the logical ATM switching node 34. For example, sum "50"+"60" = "110" of the weight information on links 215 and 217 which is the optimal path between the ATM switching nodes 112 and 115 is created in this case in the logic topology information creation section 707 of the ATM switching node 113 which is a peer group reader as weight information on a logical ATM switching node.

[0043] The case where not the optimal weight information between the ATM switching nodes 112-115 (thing of the value of min [value / weight]) but the worst weight information between the ATM switching nodes 112-115 (thing of the value of max [value / weight]) is naturally used as weight information on this logical switching node, the case where the optimal weight information between all the ATM switching nodes in the logical ATM switching node 34 is used, the case where weight information original with a logical ATM switching node is given, etc. can be considered.

[0044] How to give weight information original with a logical ATM switching node is explained concretely. For example, when the value of "20", "30", "40", "50", "60", and "70" in the weight information on each logical ATM switching nodes 31, 32, 33, 34, 35, and 36 of a network topology shown in drawing 1 is given by the above approaches, how to use the worst value in the weight information "70" etc. can be considered by them, respectively.

[0045] Since weight information (topology information) is added to the node, it becomes impossible however, to use the search algorithm of an optimal path using weight of a link like before as it is by the method which adds weight information to a logical ATM switching node in this way. Therefore, the method of giving the topology (weight) information on this logical ATM switching node to the link which the logical ATM switching node has connected to an external ATM switching node is also considered.

[0046] This approach is explained with reference to drawing 9 . The weight information on a logical ATM switching node is added to the link between the logical ATM switching node 34 and the logical ATM switching node 32, and, specifically, the weight information on the logical ATM switching node 34 is added to it also to the link between the logical ATM switching node 34 and the logical ATM switching node 35. That is, as shown in drawing 9 , the topology information between the ATM switching nodes 112-115 for which it asked by drawing 8 (weight "110") is respectively added to the link of the both sides linked to the logical ATM switching node 34.

[0047] By giving such weight information to each link, retrieval of the connection installation path which also considered the TOBOROJI information in a logical ATM switching node can be performed by the path search algorithm using the weight information on the conventional link.

[0048] As the topology information on such a logical ATM switching node is shown not only in the approach shown in drawing 9 as the approach of seasoning a link information but in drawing 10 , the method of adding by one half (weight "55") of the topology information on the logical ATM switching node 34 (weight "110") to two links linked to the logical ATM switching node 34 is also considered.

[0049] Although drawing 9 and drawing 10 show the case where the logical ATM switching node has connected with two ATM switching nodes, the actual logical ATM switching node may have connected with two or more ATM switching nodes like the logical ATM switching node 32 shown in the ATM network of drawing 1 . The configuration approach of the topology information on a logical ATM switching node linked to the ATM switching node of such a large number is shown below. As an example, the configuration approach of the topology information on the logical ATM switching node 32 is shown.

[0050] As shown in the ATM network of drawing 1 , in the logical ATM switching node 32, three ATM switching nodes 105, 106, and 107 exist. An example of the weight information on the link between these switching nodes is shown in drawing 11 .

[0051] In drawing 11 , weight "10" was given to the link 206 between the ATM switching nodes 105 and 106, weight "20" was given to the link 207 between the ATM switching nodes 105 and 107, and weight "50" is given to the link 208 between the ATM switching nodes 106 and 107.

[0052] Since all of three ATM switching nodes in the logical ATM switching node 32 shown in drawing 11 have connected with the ATM switching node besides the logical ATM switching node 32, they must compare the weight information on the link between all these ATM switching nodes as topology information on the logical ATM switching node 32.

[0053] At this time, weight "10" is the optimal value as weight of the link between the ATM switching nodes 105 and 106. Moreover, as weight of the link between the ATM switching nodes 105 and 107, weight "20" is the optimal. Furthermore, among the ATM switching nodes 106 and 107, weight "10"+"20" = "30" of the link in the case of going via links 207 and 206 is the optimal value.

[0054] As an approach of searching for the topology information on the logical ATM switching node 32 (value of weight), out of these values Like the above-mentioned approach as an approach using what has the fewest value of weight (namely, still more nearly optimal value of the values of the optimal weight of the link between each ATM switching node which constitutes a logical ATM switching node) The approach using the weight between the ATM switching nodes 105 and 106 "10", on the contrary, the thing (namely, the worst value of the values of the optimal weight of the link between each ATM switching node which constitutes a logical ATM switching node --) which has the biggest value of weight When in other words using the largest value of a safety margin, the approach using [******] the weight between the ATM switching nodes 106 and 107 "30" etc. can be considered.

[0055] Here, if it says by the thing which has the biggest value of weight (the worst weight value), i.e., the example of drawing 11 , and the value of the weight between the ATM switching nodes 106 and 107 "30" will be used as topology information on the logical ATM switching node 32 (refer to drawing 12), in all cases, weight information can be given at an insurance side.

[0056] If the worst value of the values of the optimal weight of the link between each ATM switching node which constitutes a logical ATM switching node like drawing 12 is used as topology information on the logical ATM switching node 32, also when setting up a connection path on a logical ATM network as shown in drawing 2 , an ATM connection can be set up without generating the loop formation [above-mentioned] of connection setting out.

[0057] Moreover, how to express the topology information on the logical ATM switching node linked to such three or more ATM switching nodes is not only the method which gives weight information to the logical ATM switching node itself as shown in drawing 12 like the case of the point. As shown in drawing 13 , the method which gives the value of 1/3 in one half of the weight information on the logical switching node 32 can be considered to the method which adds the weight information on the logical switching node 32 to all the links 205, 209, and 210 between the logical switching nodes 31, 33, and 34, and all the links 205, 209, and 210 between the logical switching nodes 31, 33, and 34.

[0058] Furthermore, otherwise, how to express the topology information on the logical ATM switching node linked to such three or more ATM switching nodes is considered. For example, not using the thing in the topology information between all the border nodes of the logical switching node 32 which has the biggest assessment value of weight, keeping the topology information between the border nodes of arbitration as topology information on an ATM switching node logical as it is is also considered.

[0059] In addition, specifically, the topology information between ATM switching nodes, i.e., the weight of a link, is the time delay at the time of transmitting a cel given to the link, and the attribute information on the link set up about available bandwidth. If routing is performed by approach which was mentioned above using such link attribute information, selection of the need band which can guarantee the demand quality (QoS) notified by the user at the time of a call setup, and the path with which are satisfied of a time delay can carry out easily and certainly.

[0060] As explained above, according to this operation gestalt, each switch on a communication network (101-122) The attribute information on the link during at least 1 set of boundary switches (border node) connected to others and a logic switch among the switches which constitute a logic switch (31-36) (topology information), the boundary switch — said — others — by choosing the communication path on a logic network based on the attribute information on the link between logic switches (topology information) In case the whole network is recognized using logical topology information It can recognize now with the value near actual topology information. Therefore, also when setting up a connection path on a logical ATM network as shown in drawing 2 , an ATM connection can be set up, without generating the loop formation [above-mentioned] of connection setting out.

[0061] Moreover, the inside of the optimal path during at least 1 set of boundary switches which each switch on a communication network connects to others and a logic switch among the switches which constitute a logic switch, the attribute information and the boundary switch of the link of the largest optimal path of a safety margin — said — others — by choosing the communication path on said logic network based on the attribute information on the link between logic switches In case the whole network is recognized using logical topology information, network topology information more logical to an insurance side can be offered. Therefore, also when setting up a connection path on a logical ATM network as shown in drawing 2 , an ATM connection can be set up, without generating the loop formation [above-mentioned] of connection setting out.

[0062] Moreover, it can use also for the network in the case of transmitting the information on a high speed and a broadband by using the ATM communication mode as a communication mode during each switch.

[0063] Moreover, in case a peer group's (logic switch) logical topology information is created, also when setting the connection who demands severe conditions and who transmits real-time information, such as speech information, as communicative transfer delay by using the weight about an information transfer time delay as link attribute information between the border nodes in the logic switch (boundary switch), the connection path which can offer the demand quality certainly can be set up.

[0064] Moreover, in case a peer group's (logic switch) logical topology information is created, also when setting up the connection who demands a big communication band by using the weight about bandwidth available as link attribute information between the border nodes in the logic switch (boundary switch) and who transmits wideband data, such as image information, the connection path which can offer the demand quality certainly can be set up.

[0065] Moreover, since it is not necessary to search for all the weight information between said border nodes in case a peer group's (logic switch) logical topology information is created, the processor capacity in switching node equipment required in order to create the topology information on a logic switch is reducible.

[0066] In addition, the approach indicated in the above-mentioned operation gestalt is also storable in record media, such as a floppy disk, CD-ROM, and semiconductor memory, as a program which controls each switching node equipment.

[0067] The communication network which consists of links which connect during two or more switches and said two or more switches It is a program for regarding it as the logic network containing the logic switch which consists of a having switch when few, and choosing a communication path. The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. the attribute information on the link during at least one pair of boundary switches, and this boundary switch -- said -- others -- the record medium which stored the program for controlling said each switch to choose the communication path on said logic network based on the attribute information on the link between logic switches.

[0068] The communication network which consists of links which connect during two or more switches and said two or more switches It is a program for regarding it as the logic network containing the logic switch which consists of at least one switch, and choosing a communication path. The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. The attribute information on the link of said optimal path that a safety margin is max among the optimal paths during at least one pair of boundary switches, this boundary switch -- said -- others -- the record medium which stored the program for controlling said each switch to choose the communication path on said logic network based on the attribute information on the link between logic switches.

[0069]

[Effect of the Invention] While selection of a communication path can carry out to accuracy safely according to the communication network by this invention in case the communication path in a network is chosen as explained above, the communication system using the routing approach and it which selection of the need band which can guarantee the demand quality notified by the user at the time of a call setup, and the communication path with which are satisfied of a time delay can perform easily and certainly can be offered.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] In case especially this invention searches for the setting-out path of the connection between ATM SUITCHINO 1 DO for example, about ATM communication system, it recognizes the part in an ATM network as a logical ATM switching node (peer group), and relates to the ATM network which performs a path search algorithm on the logical ATM network containing the logical ATM switching node, and performs connection setting out.

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PRIOR ART

[Description of the Prior Art] In recent years, many network products by the ATM communication mode appear in a commercial scene increasingly. Many products with the ATM switch based on the criterion of UNI3.0 especially determined in ATM-Forum or UNI3.1 or an ATM interface appear in a commercial scene, and the places which transpose the network in an enterprise to ATM-LAN have been increasing in number gradually.
[0003] However, since only UNI which is an interface between the so-called switches and terminals is carried and the product of old ATM relation did not have the interface of NNI which is an interface between the so-called switching nodes and between ATM-LAN, the approach of using a UNI interface as an NNI interface for convenience has been taken.
[0004] the decision of the specification of an NNI interface is behind compared with the decision of the specification of UNI, and it is now — the actual condition is that the ATM switch carrying an NNI interface is not produced commercially.
[0005] However, as such an interface between switching nodes, ATM-Forum determines the specification of P-NNI (Private Network Network Interface) in February, 1996, and implementation of the P-NNI method is started by many ATM switch PENDA. In this P-NNI interface specification, the network which connected two or more ATM switches is recognized as a network of an imagination layered structure. And in this virtual network, it is recognizing the subnet which consists of two or more switching nodes called a peer group in P-NNI interface specification to be one logical node, and the cutback of the **** topology information to memorize is in drawing.
[0006] Thus, in case routing is performed when the network topology has been recognized as virtual hierarchy organization, the creation method of the topology information how the topology information in each subnet recognized as a logical switching node is created which degenerated poses a problem.
[0007] A method in which this logical switching node seems not to assign fixed topology information to a logical switching node as a degeneration method of topology information, or not to have topology information at reverse can be considered. However, by such method, when searching for a routing path, the loop formation of a routing path occurred, or only the paths which are not the optimal were chosen, and there was a problem of being unable to use a network resource efficiently.
[0008] An example of a communication network which used the ATM communication mode for drawing 1 as topology of the communication network which such a problem generates is shown. Two or more ATM switching nodes 101 and 102—122 exist in this communication network, and between those ATM switching nodes has a link 201 and composition connected by 202—228.
[0009] In drawing 1 , the P-NNI method which ATM-Forum specified as an interface between this ATM switching node shall be used, and topology information on each ATM switching node or a logical ATM switching node shall be delivered and received between this ATM switching node.
[0010] In the communication network of drawing 1 , the 22 above-mentioned ATM switching nodes are divided into six ATM switching nodes (peer group) 310, 320, 330, 340, 350, and 360, and each peer group is recognized to be the logical ATM switching nodes 31-36. Therefore, make into an imagination low order hierarchy's topology topology of the network constituted by 22 ATM switching nodes which were shown in the lower part of drawing 1 , and which exist really, and let topology of the logical network constituted by six logical ATM switching nodes shown in the upper part of drawing 1 be an imagination high order hierarchy's topology.
[0011] The ATM switching node 101 in the communication network of drawing 1 used as the topology of such virtual hierarchy organization will recognize it as logical topology as shows the topology of the whole communication network of drawing 1 to drawing 2 . And when setting up an ATM connection from the ATM switching node 101, using the network of topology shown in this drawing 2 , it will search for an ATM connection's setting-out path, and signaling processing for ATM connection setting out will be performed.
[0012] usually, in order to search for the communication path which becomes the optimal [for

communicating in a network], weight (for example, weight about a time delay and a band) is given to each link in a network, and the method which chooses a communication path (namely, — for example, the band which needs [the minimum or] a time delay is securable) from which the sum of the weight becomes min between the terminals which communicate is used.

[0013] An example of the weight of the link on the network shown in drawing 3 at drawing 2 is shown. On the network of drawing 2 , the case where it is presupposed that each logic ATM switching node does not have the weight of the link used as topology information in the logical ATM switching node 31-36 of drawing 1 although two or more ATM switching nodes and links exist actually is shown. The network topology of **** Li and drawing 3 will lack the logical ATM switching nodes 32, 33, 34, and 35 and the topology information on the link in 36. On the ATM network which performs such topology recognition, the above communication-path search algorithms are performed and the ATM connection setting-out approach in the case of setting the ATM connection to the ATM switching nodes 101-122 in the network of drawing 1 as below is shown as an example of an approach which sets up an ATM connection.

[0014] First, since the switching node 101 recognizes the network topology like drawing 2 , an ATM connection's setting-out path search algorithm is performed on the logical ATM network of drawing 2 .

[0015] Since the ATM switching node 122 of an ATM connection setting-out place belongs to the logical ATM switching node 36 at this time, in case a path search algorithm is performed actually, it will search for the ATM connection setting-out path from the ATM switching node 101 to the logical ATM switching node 36.

[0016] As shown in drawing 3 , supposing the weight information on the link in a network is given, as a path from which the sum of the value of the weight of a link becomes min, the path which goes via the ATM switching node and the logical ATM switching node which are called 102->104->32->34->35->36 will be chosen from the ATM switching node 101 as order. Here, in the logical ATM network shown in drawing 2 , since the logical ATM switching nodes 32, 33, 34, and 35 and the topology information in 36 are concealed, when setting up an ATM connection actually, the path of the ATM connection who sets up in these logical ATM switching nodes must be uniquely set up in each logic ATM switching node, respectively.

[0017] Therefore, after the path of the ATM connection on the logical ATM network topology of drawing 2 is chosen, the path in the logical ATM switching node 32 will be chosen, and the path in the logical ATM switching nodes 34 and 35 and 36 will be chosen one by one.

[0018] However, by the conventional method, since each logic ATM switching node performs a path search algorithm in the form where existence of the logical ATM switching nodes 32, 34, and 35, the ATM switching node in 36, and a link is disregarded, the following problems arise.

[0019] The case where the actual weight of the link in the logical ATM switching node 34 has become like drawing 4 as an example is assumed. In drawing 4 , for example, weight "50" is given to the links 215 and 216 in a logical ATM switching node, and weight "100" is given to weight "60" and a link 218 in the link 219. In accordance with the connection path chosen on the ATM network of drawing 2 , sequential setting out is carried out and an ATM connection presupposes that processing came to the logical ATM switching node 34. At this time, the actual ATM switching node 112 in the logical ATM switching node 34 to which connection setting-out processing was passed from the logical ATM switching node 32 will perform setting-out processing of a connection.

[0020] The topology information on the ATM network shown in drawing 1 which the ATM switching node 112 recognizes to drawing 5 is shown. On the network topology of drawing 5 , when the ATM switching node 112 searches for the optimal path to the ATM switching node 122 (logical ATM switching node 36) of the destination, unlike the path which the ATM switching node 101 chose previously, the result that the path of 112->32->33->35->36 is an optimal path is brought. for this reason, in case a actual ATM connection is set up, the loop formation of connection setting out will occur among the ATM switching nodes 107 and 112 actual — among the logical ATM switching nodes 32 and 34.

[0021] It is ATM-Forum in order to avoid generating of such a loop formation of connection setting out. Although the method which recognizes the TOBOROJI information on a logic node supposing the imagination star mold topology which consists of P-NNI methods by the link called Radius as the recognition approach of a logical topology configuration is shown, reference is not made about the creation method of the topology information on the imagination link called the Radius.

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EFFECT OF THE INVENTION

[Effect of the Invention] While selection of a communication path can carry out to accuracy safely according to the communication network by this invention in case the communication path in a network is chosen as explained above, the communication system using the routing approach and it which selection of the need band which can guarantee the demand quality notified by the user at the time of a call setup, and the communication path with which are satisfied of a time delay can perform easily and certainly can be offered.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] As stated above, since topology information on a logical switching node could not be estimated to be an accuracy and insurance side, when it was going to set up a connection in a network, by the creation approach of the topology information on the conventional technique, the problem that a loop formation occurred was in the connection path.
[0023] This invention is what was made in view of this point. Each switching node in a communication network By estimating the topology information given between the switching nodes which constitute the logical switching node to be an insurance side, in case the topology information on a logical switching node that the switching node is contained is created It aims at offering the communication system using the routing approach and it of a connection's loop formation which can be performed to accuracy safely [generate namely, / selection of a communication path] at the time of routing activation.
[0024] Moreover, selection of the need band which can guarantee the demand quality notified by the user at the time of a call setup, and the communication path with which are satisfied of a time delay aims at offering the communication system using the routing approach and it which can be performed easily and certainly.

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MEANS

[Means for Solving the Problem] The routing approach of this invention the communication network which consists of links which connect during two or more switches and said two or more switches In the routing approach which regards it as the logic network containing the logic switch which consists of at least one switch, and chooses a communication path said each switch The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. the attribute information on the link during at least one pair of boundary switches, and this boundary switch — said — others — by choosing the communication path on said logic network based on the attribute information on the link between logic switches In case the whole network is recognized using logical topology information, it can recognize with the value near actual topology information. Therefore, selection of a communication path can carry out to accuracy safely.
[0026] The routing approach of this invention moreover, the communication network which consists of links which connect during two or more switches and said two or more switches In the routing approach which regards it as the logic network containing the logic switch which consists of at least one switch, and chooses a communication path said each switch The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. The attribute information on the link of said optimal path that a safety margin is max among the optimal paths during at least one pair of boundary switches, this boundary switch — said — others — by choosing the communication path on said logic network based on the attribute information on the link between logic switches In case the whole network is recognized using logical topology information, network topology information more logical to an insurance side can be offered. Therefore, selection of a communication path can carry out to accuracy safely.
[0027] Moreover, since the ATM communication mode is used as a communication mode during each switch, it can use also for the network in the case of transmitting the information on a high speed and a broadband. Moreover, also when setting the connection who demands severe conditions and who transmits real-time information, such as speech information, as communicative transfer delay by using the weight about an information transfer time delay as link attribute information, the connection path which can offer the demand quality certainly can be set up.
[0028] Moreover, also when setting up the connection who demands a big communication band by using the weight about available bandwidth as attribute information on a link and who transmits wideband data, such as image information, the connection path which can offer the demand quality certainly can be set up.

[0029]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing. As an example of the topology of the communication network which consists of communication system of this invention, the operation gestalt of this invention is explained using the communication network shown in drawing 1 .
[0030] Two or more ATM switching nodes 101-122 exist, between these ATM switching nodes is connected by links 201-228, and the communication network of drawing 1 is constituted.
[0031] The 22 above-mentioned ATM switching nodes are divided into six ATM switching nodes (peer group), and let each peer group be the logical ATM switching nodes 31-36.
[0032] In drawing 1 , the P-NNI method which ATM-Forum specified shall be used as an interface between this ATM switching node, and topology information on each ATM switching node or a logical ATM switching node shall be delivered and received between this ATM switching node.
[0033] As mentioned above, make into an imagination low order hierarchy's topology topology of the network constituted by 22 ATM switching nodes which were shown in the lower part of drawing 1 , and which exist really, and let topology of the logical network constituted by six logical ATM switching nodes shown in the upper part of drawing 1 be an imagination high order hierarchy's topology.

[0034] The ATM switching node 101 in the communication network of drawing 1 used as the topology of such virtual hierarchy organization will recognize it as logical topology as shows the topology of the whole communication network of drawing 1 to drawing 2 . That is, the logical network recognized from the ATM switching node 101 will consist of the ATM switching nodes 102-104, logical ATM switching nodes 32-36 and links 201-205 that connect these, and 209, 210, 219, 220 and 224, and will recognize [the ATM switching node 101] this configuration, each links 201-205, and the information about 209, 210, 219, 220, and 224 as topology information.

[0035] Next, each ATM switching node of drawing 1 is explained with reference to drawing 6 and drawing 7 . As shown in drawing 1 , to the ATM switching node in the communication network where this invention is applied The usual ATM switching nodes 101, 103-105 which create only the topology information on the link linked to a self-node and a self-node, 107-109, 111-112, 114-117, and 119-121, Two kinds of the logical topology information creation nodes (it is hereafter called a peer group reader) 102, 106, 110, 113, 118, and 122 which create each peer group's logical topology information exist for every peer group.

[0036] An example of the internal configuration of the usual ATM switching node (equipment) is shown in drawing 6 . As shown in drawing 6 , the usual ATM switching node 600 The topology information notified through a link from other ATM switching nodes is received. Topology information reception / storage section 601 which memorizes those information, The network topology creation section 602 which creates the topology information on the whole network based on those topology information, The routing control section 603 which calculates a connection's setting-out path based on the network topology created in the network topology creation section 602, The self-node topology information creation section 605 which creates the topology information on the link linked to a self-node and a self-node based on a connection's condition set up in each ATM switching node, The advice section 604 of topology information which notifies the created self-node topology information through a link to other ATM switches is provided.

[0037] An example of the internal configuration of an ATM switching node (equipment) which serves as a peer group reader is shown in drawing 7 . . As shown in drawing 7 , the ATM switching node 700 which serves as a peer group reader Topology information reception / storage section 701 which receives and memorizes topology information from other ATM switching nodes like the usual ATM switching node 600, The network topology creation section 702 which creates the topology information on the whole network based on those topology information, The routing control section 703 which calculates a connection's setting-out path, and the self-node topology information creation section 704 which creates the TOBOROJI information on the link linked to a self-node and a self-node are provided.

[0038] Furthermore, the ATM switching node 700 which serves as a peer group reader The ATM switching node linked to ATM switching nodes other than a self-peer group memorized by topology information reception / storage section 701 The TOBOROJI information creation section 706 between border nodes which searches for the optimal path between border nodes, and creates the topology information between each border node from the TOBOROJI information on between [(it is hereafter called a border node)], Based on the topology information between each called-for border node, the logical topology information creation section 707 which creates a self-peer group's logical topology information is provided.

[0039] From the advice section 705 of topology information in the ATM switching node 700 which serves as a peer group reader, a self-peer group's logical topology information created in the logical topology information creation section 707 will also be notified through a link to other ATM switching nodes with the self-node topology information created in the self-node topology information creation section 704.

[0040] In order to avoid generating of the loop formation at the time of connection setting out shown in the conventional example in the communication network constituted by the ATM switching node of a configuration as shown in drawing 6 and drawing 7 , topology information is also respectively given to the logical ATM switching nodes 31-36 of drawing 1 .

[0041] Next, an example of how to give the logical topology information on the logical ATM switching node 34 with topology information as shown in drawing 4 with reference to drawing 8 is explained.

[0042] In drawing 8 , since the weight of the link in the logical ATM switching node 34 has become like drawing 4 , logical ATM switching node 34 self has the weight information on a link. At this time, the weight information which the logical ATM switching node 34 has is made based on the topology information between the ATM switching nodes 112 and 115 linked to the ATM switching node in the logical ATM switching node 34 in the ATM switches 112, 113, 114, and 115 in the logical ATM switching node 34. For example, sum "50"+"60" = "110" of the weight information on links 215 and 217 which is the optimal path between the ATM switching nodes 112 and 115 is created in this case in the logic topology information creation section 707 of the ATM switching node 113 which is a peer group reader as weight information on a logical ATM switching node.

[0043] The case where not the optimal weight information between the ATM switching nodes 112-115 (thing of the value of min [value / weight]) but the worst weight information between the ATM switching nodes 112-115 (thing of the value of max [value / weight]) is naturally used as weight information on this logical switching node, the case where the optimal weight information between all the ATM switching nodes in the logical ATM switching node 34 is used, the case where weight information original with a logical ATM switching node is given, etc. can be considered.

[0044] How to give weight information original with a logical ATM switching node is explained concretely. For example, when the value of "20", "30", "40", "50", "60", and "70" in the weight information on each logical ATM switching nodes 31, 32, 33, 34, 35, and 36 of a network topology shown in drawing 1 is given by the above approaches, how to use the worst value in the weight information "70" etc. can be considered by them, respectively.

[0045] Since weight information (topology information) is added to the node, it becomes impossible however, to use the search algorithm of an optimal path using weight of a link like before as it is by the method which adds weight information to a logical ATM switching node in this way. Therefore, the method of giving the topology (weight) information on this logical ATM switching node to the link which the logical ATM switching node has connected to an external ATM switching node is also considered.

[0046] This approach is explained with reference to drawing 9 . The weight information on a logical ATM switching node is added to the link between the logical ATM switching node 34 and the logical ATM switching node 32, and, specifically, the weight information on the logical ATM switching node 34 is added to it also to the link between the logical ATM switching node 34 and the logical ATM switching node 35. That is, as shown in drawing 9 , the topology information between the ATM switching nodes 112-115 for which it asked by drawing 8 (weight "110") is respectively added to the link of the both sides linked to the logical ATM switching node 34.

[0047] By giving such weight information to each link, retrieval of the connection installation path which also considered the TOBOROJI information in a logical ATM switching node can be performed by the path search algorithm using the weight information on the conventional link.

[0048] As the topology information on such a logical ATM switching node is shown not only in the approach shown in drawing 9 as the approach of seasoning a link information but in drawing 10 , the method of adding by one half (weight "55") of the topology information on the logical ATM switching node 34 (weight "110") to two links linked to the logical ATM switching node 34 is also considered.

[0049] Although drawing 9 and drawing 10 show the case where the logical ATM switching node has connected with two ATM switching nodes, the actual logical ATM switching node may have connected with two or more ATM switching nodes like the logical ATM switching node 32 shown in the ATM network of drawing 1 . The configuration approach of the topology information on a logical ATM switching node linked to the ATM switching node of such a large number is shown below. As an example, the configuration approach of the topology information on the logical ATM switching node 32 is shown.

[0050] As shown in the ATM network of drawing 1 , in the logical ATM switching node 32, three ATM switching nodes 105, 106, and 107 exist. An example of the weight information on the link between these switching nodes is shown in drawing 11 .

[0051] In drawing 11 , weight "10" was given to the link 206 between the ATM switching nodes 105 and 106, weight "20" was given to the link 207 between the ATM switching nodes 105 and 107, and weight "50" is given to the link 208 between the ATM switching nodes 106 and 107.

[0052] Since all of three ATM switching nodes in the logical ATM switching node 32 shown in drawing 11 have connected with the ATM switching node besides the logical ATM switching node 32, they must compare the weight information on the link between all these ATM switching nodes as topology information on the logical ATM switching node 32.

[0053] At this time, weight "10" is the optimal value as weight of the link between the ATM switching nodes 105 and 106. Moreover, as weight of the link between the ATM switching nodes 105 and 107, weight "20" is the optimal. Furthermore, among the ATM switching nodes 106 and 107, weight "10"+"20" = "30" of the link in the case of going via links 207 and 206 is the optimal value.

[0054] As an approach of searching for the topology information on the logical ATM switching node 32 (value of weight), out of these values Like the above-mentioned approach as an approach using what has the fewest value of weight (namely, still more nearly optimal value of the values of the optimal weight of the link between each ATM switching node which constitutes a logical ATM switching node) The approach using the weight between the ATM switching nodes 105 and 106 "10", on the contrary, the thing (namely, the worst value of the values of the optimal weight of the link between each ATM switching node which constitutes a logical ATM switching node --) which has the biggest value of weight When in other words using the largest value of a safety margin, the approach using [******] the weight between the ATM switching nodes 106 and 107 "30" etc. can be considered.

[0055] Here, if it says by the thing which has the biggest value of weight (the worst weight value), i.e., the example of drawing 11 , and the value of the weight between the ATM switching nodes 106 and 107 "30" will be used as topology information on the logical ATM switching node 32 (refer to drawing 12), in all cases, weight information can be given at an insurance side.

[0056] If the worst value of the values of the optimal weight of the link between each ATM switching node which constitutes a logical ATM switching node like drawing 12 is used as topology information on the logical ATM switching node 32, also when setting up a connection path on a logical ATM network as shown in drawing 2 , an ATM connection can be set up without generating the loop formation [above-mentioned] of connection setting out.

[0057] Moreover, how to express the topology information on the logical ATM switching node linked to such three or more ATM switching nodes is not only the method which gives weight information to the logical ATM switching node itself as shown in drawing 12 like the case of the point. As shown in drawing 13 , the method which gives the value of 1/3 in one half of the weight information on the logical switching node 32 can be considered to the method which adds the weight information on the logical switching node 32 to all the links 205, 209, and 210 between the logical switching nodes 31, 33, and 34, and all the links 205, 209, and 210 between the logical switching nodes 31, 33, and 34.

[0058] Furthermore, otherwise, how to express the topology information on the logical ATM switching node linked to such three or more ATM switching nodes is considered. For example, not using the thing in the topology information between all the border nodes of the logical switching node 32 which has the biggest assessment value of weight, keeping the topology information between the border nodes of arbitration as topology information on an ATM switching node logical as it is is also considered.

[0059] In addition, specifically, the topology information between ATM switching nodes, i.e., the weight of a link, is the time delay at the time of transmitting a cel given to the link, and the attribute information on the link set up about available bandwidth. If routing is performed by approach which was mentioned above using such link attribute information, selection of the need band which can guarantee the demand quality (QoS) notified by the user at the time of a call setup, and the path with which are satisfied of a time delay can carry out easily and certainly.

[0060] As explained above, according to this operation gestalt, each switch on a communication network (101-122) The attribute information on the link during at least 1 set of boundary switches (border node) connected to others and a logic switch among the switches which constitute a logic switch (31-36) (topology information), the boundary switch — said — others — by choosing the communication path on a logic network based on the attribute information on the link between logic switches (topology information) In case the whole network is recognized using logical topology information It can recognize now with the value near actual topology information. Therefore, also when setting up a connection path on a logical ATM network as shown in drawing 2 , an ATM connection can be set up, without generating the loop formation [above-mentioned] of connection setting out.

[0061] Moreover, the inside of the optimal path during at least 1 set of boundary switches which each switch on a communication network connects to others and a logic switch among the switches which constitute a logic switch, the attribute information and the boundary switch of the link of the largest optimal path of a safety margin — said — others — by choosing the communication path on said logic network based on the attribute information on the link between logic switches In case the whole network is recognized using logical topology information, network topology information more logical to an insurance side can be offered. Therefore, also when setting up a connection path on a logical ATM network as shown in drawing 2 , an ATM connection can be set up, without generating the loop formation [above-mentioned] of connection setting out.

[0062] Moreover, it can use also for the network in the case of transmitting the information on a high speed and a broadband by using the ATM communication mode as a communication mode during each switch.

[0063] Moreover, in case a peer group's (logic switch) logical topology information is created, also when setting the connection who demands severe conditions and who transmits real-time information, such as speech information, as communicative transfer delay by using the weight about an information transfer time delay as link attribute information between the border nodes in the logic switch (boundary switch), the connection path which can offer the demand quality certainly can be set up.

[0064] Moreover, in case a peer group's (logic switch) logical topology information is created, also when setting up the connection who demands a big communication band by using the weight about bandwidth available as link attribute information between the border nodes in the logic switch (boundary switch) and who transmits wideband data, such as image information, the connection path which can offer the demand quality certainly can be set up.

[0065] Moreover, since it is not necessary to search for all the weight information between said border nodes in case a peer group's (logic switch) logical topology information is created, the processor capacity in switching node equipment required in order to create the topology information on a logic switch is

reducible.
[0066] In addition, the approach indicated in the above-mentioned operation gestalt is also storable in record media, such as a floppy disk, CD-ROM, and semiconductor memory, as a program which controls each switching node equipment.
[0067] The communication network which consists of links which connect during two or more switches and said two or more switches It is a program for regarding it as the logic network containing the logic switch which consists of a having switch when few, and choosing a communication path. The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. the attribute information on the link during at least one pair of boundary switches, and this boundary switch — said — others — the record medium which stored the program for controlling said each switch to choose the communication path on said logic network based on the attribute information on the link between logic switches.
[0068] The communication network which consists of links which connect during two or more switches and said two or more switches It is a program for regarding it as the logic network containing the logic switch which consists of at least one switch, and choosing a communication path. The switch connected to others and a logic switch among the switches which constitute said logic switch is considered as a boundary switch. The attribute information on the link of said optimal path that a safety margin is max among the optimal paths during at least one pair of boundary switches, this boundary switch — said — others — the record medium which stored the program for controlling said each switch to choose the communication path on said logic network based on the attribute information on the link between logic switches.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing having shown an example of the physical-connection topology of the communication network concerning the operation gestalt of this invention.
[Drawing 2] Drawing having shown an example of the logical connection topology of the communication network of drawing 1 .
[Drawing 3] Drawing having shown an example of the topology information in the logical switching node of the communication network of drawing 2 .
[Drawing 4] Drawing having shown an example of the topology information in a logical switching node.
[Drawing 5] Drawing having shown an example of the topology information on the logic network which the switching node in the logic switching node shown in drawing 4 recognizes.
[Drawing 6] Drawing having shown roughly the example of a configuration of the important section of an ATM switching node.
[Drawing 7] Drawing having shown roughly the example of a configuration of the important section of an ATM switching node shows the case of a peer group reader.
[Drawing 8] Drawing for explaining the creation approach of topology information of a logical switching node (when the number of border nodes being two).
[Drawing 9] Drawing for explaining the creation approach of everything but topology information of a logical switching node (when the number of border nodes is two).
[Drawing 10] Drawing for explaining the creation approach [of topology information] of further others of a logical switching node (when the number of border nodes being two).
[Drawing 11] Drawing for explaining the creation approach of topology information of a logical switching node (when the number of border nodes being three).
[Drawing 12] Drawing for explaining the creation approach of everything but topology information of a logical switching node (when the number of border nodes is three).
[Drawing 13] Drawing for explaining the creation approach [of topology information] of further others of a logical switching node (when the number of border nodes being three).
[Description of Notations]
101-122 — An ATM switching node, 201-228 — The link between ATM switching nodes, 31-36 — Logical switching node.

[Translation done.]

* NOTICES *

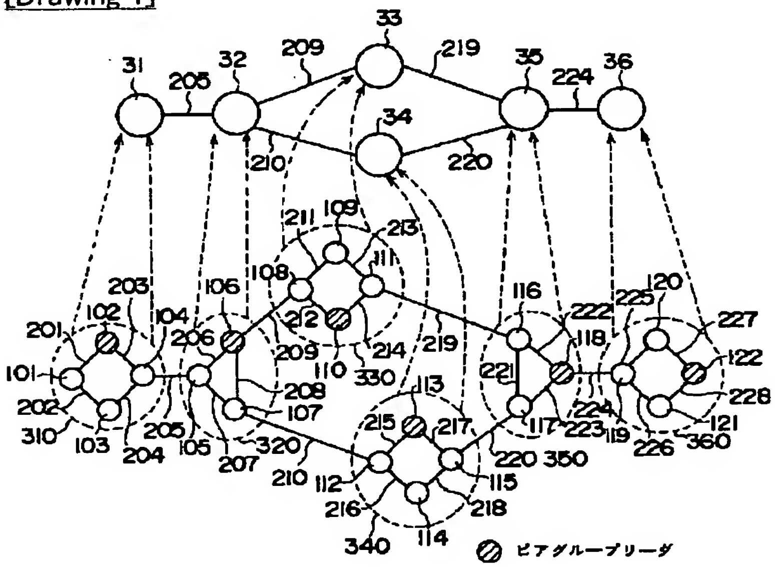
JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]


31
32
33
34
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36
205
209
210
219
220
224
101
102
103
104
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107
108
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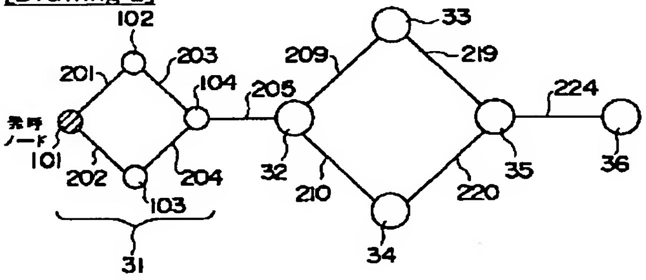
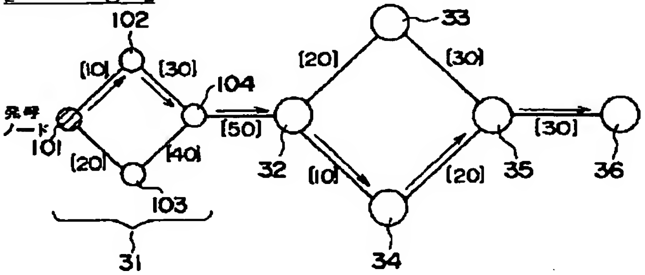
225
226
227
228
310
320
330
340
350
360
ピアグループリーダ

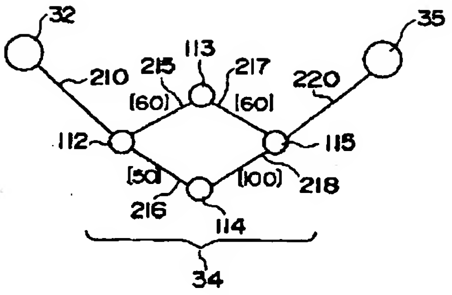
[Drawing 2]


102
201
203
104
205
209
33
219
224
発呼ノード
101
202
204
103
32
210
34
220
35
36
31

[Drawing 3]

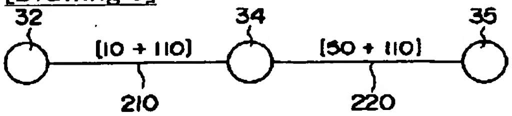

102
[10]
[30]
104
[20]
33
[30]
発呼ノード
101
[50]
[30]
[20]
[40]
32
[10]
[20]
35
36
103
31
34

[Drawing 4]



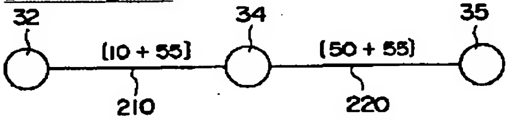
32
35
113
210
215
217
220
[60]
[60]
112
115
[50]
[100]
218
216
114
34

[Drawing 9]



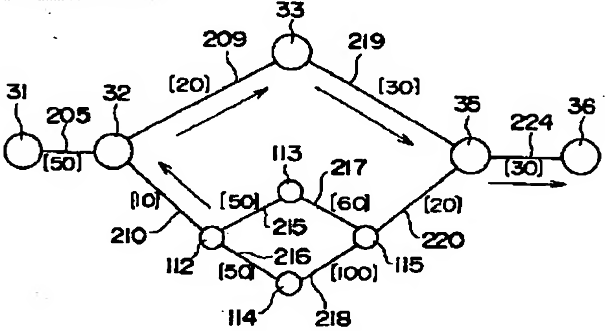
32
34
35
[10 + 110]
[50 + 110]
210
220

[Drawing 10]



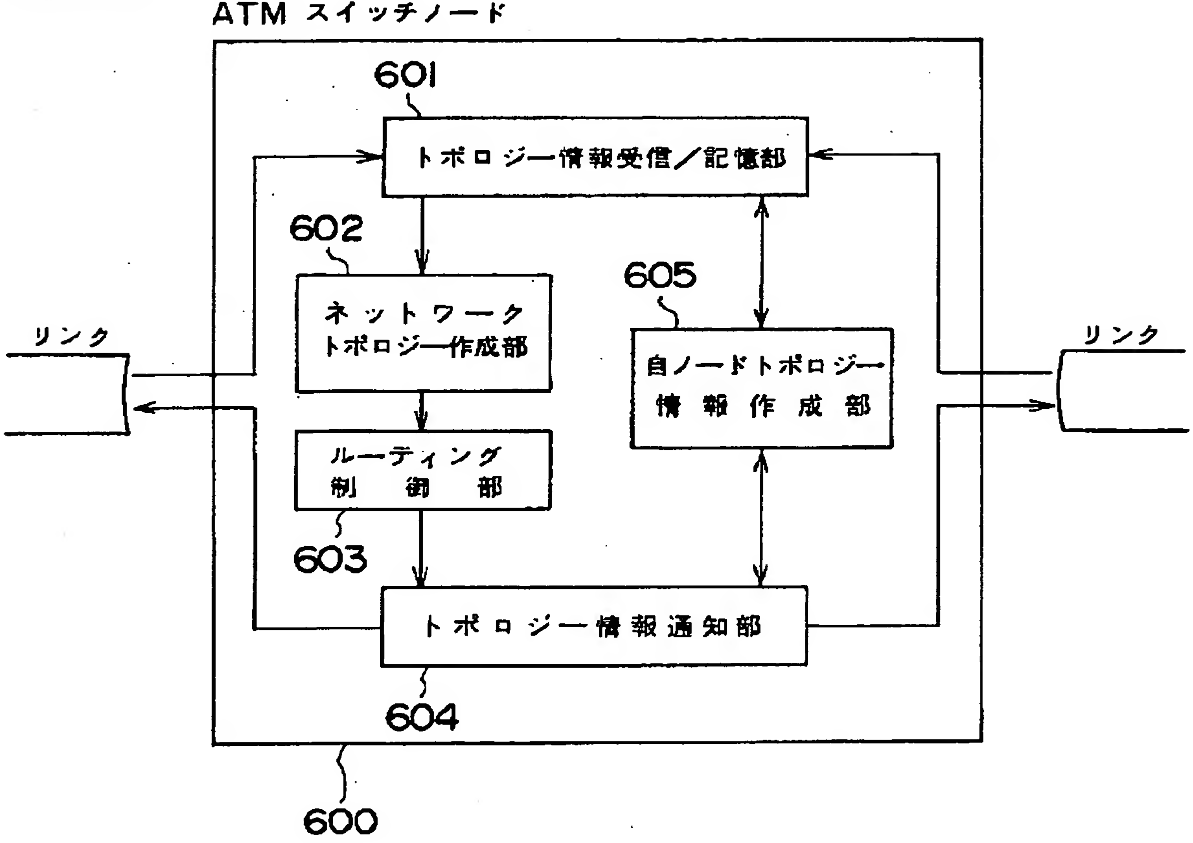
32
34
35
[10 + 55]
[50 + 55]
210
220

[Drawing 5]



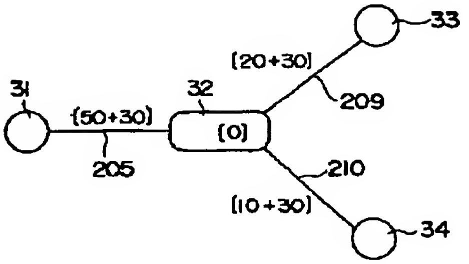
33
209
219
[20]
[30]
31
205
32
35
224
36
[50]
[30]
113
217
[10]
[50]
[60]
215
[20]
210
216
220
112
[50]
[100]
115
114
218

[Drawing 6]

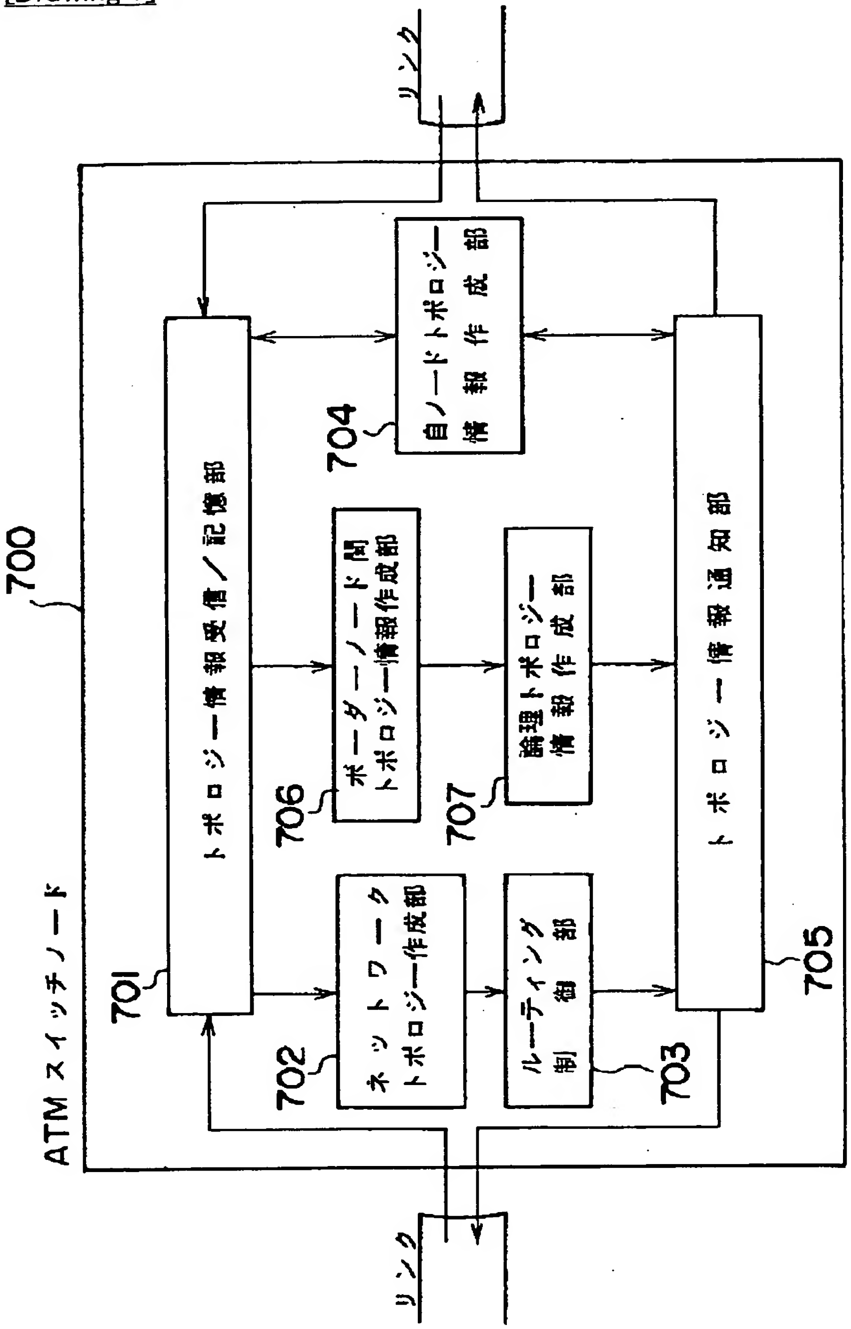


ATM スイッチノード
601
トポロジー情報受信／記憶部
602
ネットワークトポロジー作成部
605
自ノードトポロジー情報作成部
リンク
リンク
ルーティング制御部
603
トポロジー情報通知部
604
600

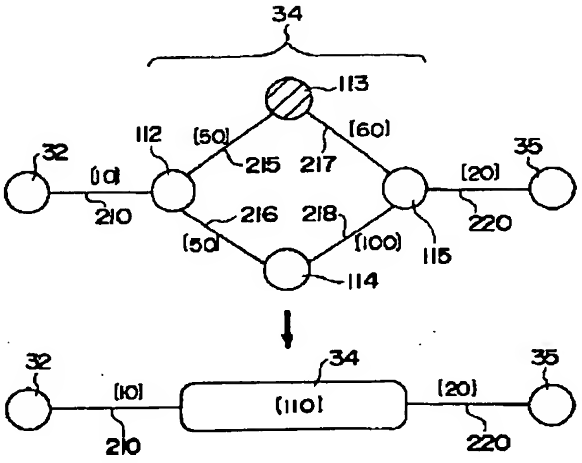
[Drawing 13]


31
(50+30)
205
32
(0)
(20+30)
209
33
210
(10+30)
34

[Drawing 7]


700
ATMスイッチノード
リンク
リンク
701
トポロジー情報受信／記憶部
702
ネットワークトポロジー作成部
703
ルーティング制御部
704
自ノードトポロジー情報作成部
705
トポロジー情報通知部
706
ボーダーノード間トポロジー情報作成部
707
論理トポロジー情報作成部

[Drawing 8]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113
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[20]
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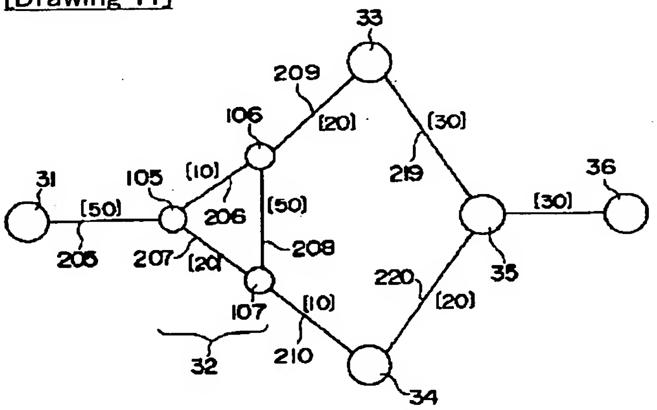
220
[50]
[100]
115
114
32
34
35
[10]
[110]
[20]
210
220

[Drawing 11]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209
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36
[50]
206
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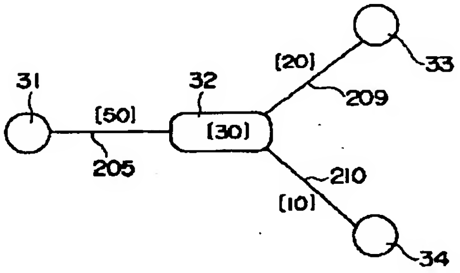
205
207
[20]
208
220
35
107
[10]
[20]
32
210
34

[Drawing 12]


31
32
[20]
33
209
[50]
[30]
205
210
[10]
34

[Translation done.]